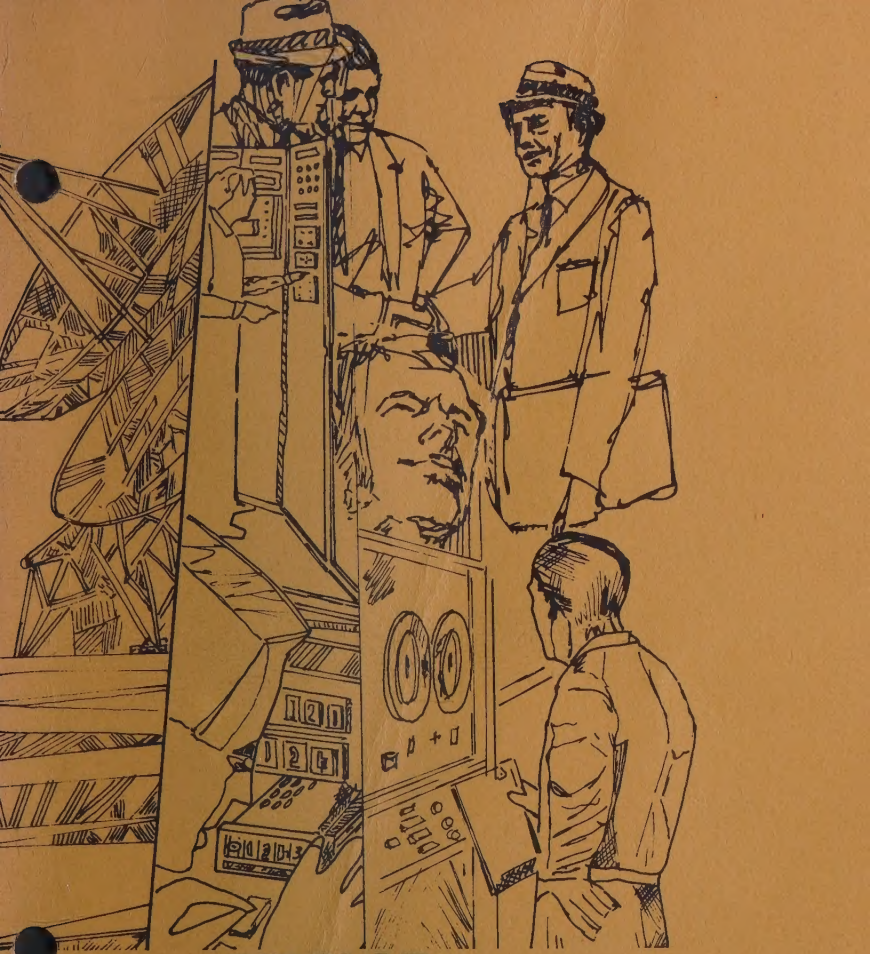

MODEL 1292 BIPOLAR DIGITAL PANEL METER

INSTRUCTIONS
WITH PARTS LIST

WESTON®

INSTRUCTIONS WITH PARTS LIST

FOR

WESTON®
MODEL 1292

BI POLAR
DIGITAL PANEL METER

U.S. Patent 3,051,939
and Patents Pending

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WESTON INSTRUMENTS, INC.
614 FRELINGHUYSEN AVENUE, NEWARK, N. J. 07114

WESTON
Schlumberger

F3620 R5

Printed in U.S.A.

GENERAL SPECIFICATIONS *

Minimum Range	00.0 to 100.0 Millivolts D. C.
Over Range	100% (except for 1000 volt Range)
Out Range Indication	±300%(except for 1000 volt Range)
Rated Accuracy	±0.1% of Full Scale ±1 digit
Input Resistance	100 Meg Ohms
Common Mode Rejection Ratio	80 DB with 1000 ohm unbalance at 60 Hz
Normal Mode Rejection Ratio	35 DB at 60 Hz
Speed	0.20 seconds per reading
Response Time	2.0 seconds
Max. Voltage Overload	60 Volts D. C.
Stability	±0.1% Full Scale
Power	117 Volt Nominal, (105 to 129) 50 to 400 Hz. 7 watts
Weight	1 lb. 4 oz.
Operating Temperature	15°C to 35°C
Extreme Operating Range	5°C to 45°C
Storage Temperature	-40°C to 70°C

Refer to Table 1 for a tabulation of specifications pertaining to specific instruments.

*Specifications subject to change without notice

TABLE 1.

TABLE OF SPECIFICATIONS *

WESTON® PART NUMBER	RANGE (DC)	SENSITIVITY	INPUT IMPEDANCE	FULL SCALE † PRESENTATION	NAME PLATE DATA	MAXIMUM VOLTAGE OVERLOAD	EFFECTIVE COMMON MODE REJECTION AT 60 Hz
1292-0270204	1000 Volts	1.0 V	10 Meg	1000	Volts DC	1100 V	Minus Terminal GND
1292-0270203	100 Volts	0.1 V	10 Meg	100.0	Volts DC	1000 V	74 DB
1292-0270202	10 Volts	0.01 V	10 Meg	10.00	Volts DC	1000 V	80 DB
1292-0270201	1 Volt	0.001 V	1000 Meg	1.000	Volts DC	120 V	80 DB
1292-0270200	100 Millivolts	0.1 MV	100 Meg	100.0	Millivolts DC	60 V	80 DB
1292-0270211	100 Milliamperes	0.1 ma	1 Ohm	100.0	Milliamperes DC	---	---
1292-0270210	10 Milliamperes	0.01 ma	10 Ohm	10.00	Milliamperes DC	---	---
1292-0270208	1 Milliampere	0.001 ma	100 Ohm	1.000	Milliamperes DC	---	---
1292-0270207	100 Microamperes	0.1 μa	1 K Ohm	100.0	Microamperes DC	---	---
1292-0270206	10 Microamperes	0.01 μa	10 K Ohm	10.00	Microamperes DC	---	---
1292-0270205	1 Microampere	0.001 μa	100 K Ohm	1.000	Microamperes DC	---	---

† With 100% Overrange on all ranges except 1000 volt range

Max. Overrange presentation 1999 on all ranges except 1000 volt range.

* Specifications subject to change without notice

Max. voltage between common input terminal pin 10 and earth ground or shield pin R (500v RMS AC/DC) except on the 1000v range.

GENERAL

The Weston Model 1292 Digital Panel Meter is a miniature single range, Bi-polar, high input impedance instrument designed to indicate input DC voltage or current in one of 11 possible ranges. The display is digital rather then the previous standard analog moving pointer method. Full scale is 1000 digits with over-range capability to 1999. All design features are in keeping with panel meter usage but the digital concept provides linearity, high accuracy, stability and speed of reading without consideration of such factors as parallax, reader interpretation or tracking inherent in analog devices.

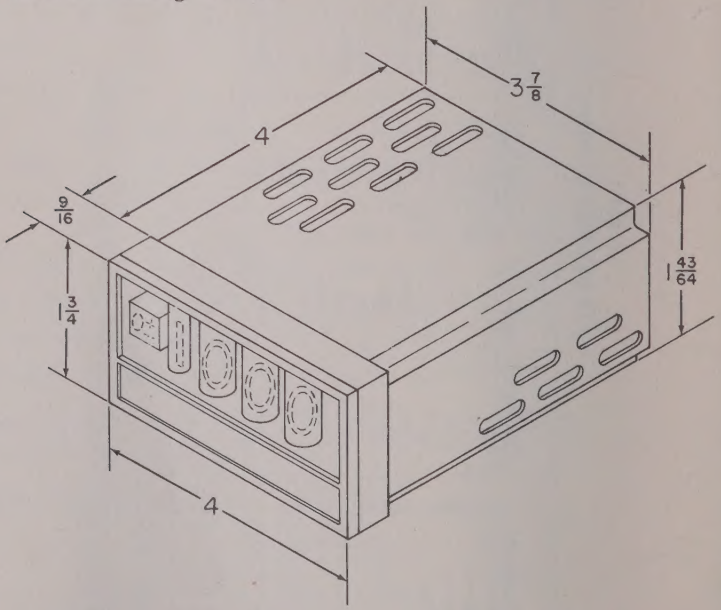

Figure 1. Outline Dimensional Drawing

The meter is provided with a 100% over-range capability on all ranges except the 1000 Volt DC full scale range.

An automatic over-range lamp is provided to indicate that the meter is operating above 100% over-range.

Plus "+" and minus "-" indicators are provided to indicate the polarity of the signal being measured.

Three decades of 1-2-4-8 BCD (Binary Coded Decimal) and the numeric 1000 are provided as additional features. The display hold is provided to hold the last reading displayed on the readout tubes and the BCD outputs, but allows the conversion process to continue. The polarity hold is provided to hold the last polarity indication, but allowing the instrument to continue measuring the input signal. The BCD decades are used to provede outputs to drive external equipment. External selection of decimal points hundreds, tens and units.

The case front has a circularly polarized filter window to eliminate glare. Zero adjustment facilities are provided. The adjustments are made accessable by removing the front assembly, zero adjustment may be made over a range of greater than +10 counts.

The meter is manufactured by Weston Instruments, Inc., Newark, New Jersey. All inquiries pertaining to operation or repair of this instrument should be directed to Weston - Newark. For a pictorial view of the meter and overall dimensions, refer to Figure 1, Outline Dimensional Drawing.

INSTALLATION AND OPERATING INSTRUCTIONS

PANEL MOUNTING

1. Unpack the meter and perform a visual inspection to assure that no damage has occurred during shipment or handling.

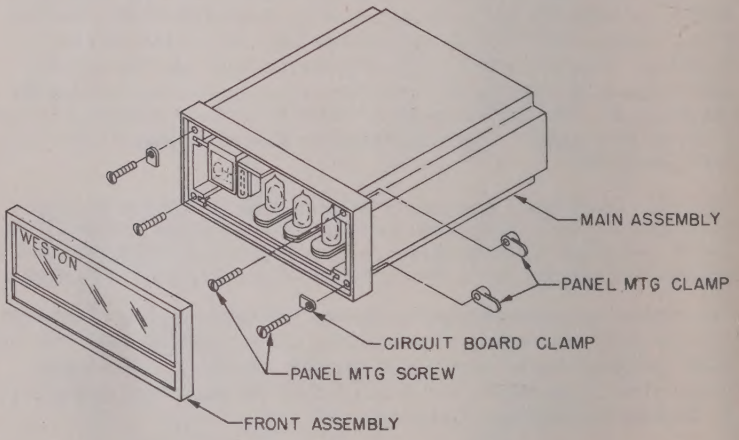

Figure 2. Meter Mounting Drawing

2. Remove front assembly. Rotate the four mounting screws (located in the four inner corners) 3 or 4 times counter clockwise to position the mounting cams correctly. Mount the main assembly (see Figure 2) on a panel 1/16 to 1/8 inch thick. The panel shall be prepared in accordance with the panel cut out dimensions as shown in Figure 3. Rotate the four mounting screws clockwise to position the mounting cams in the lock, position and secure the instrument to the panel.

3. Check the display tubes to assure that they are securely mounted to their sockets. Press loose tubes down gently to obtain a secure mounting.

4. The front assembly can be secured into position at this time. This front assembly will have to be removed to adjust and calibrate the meter.

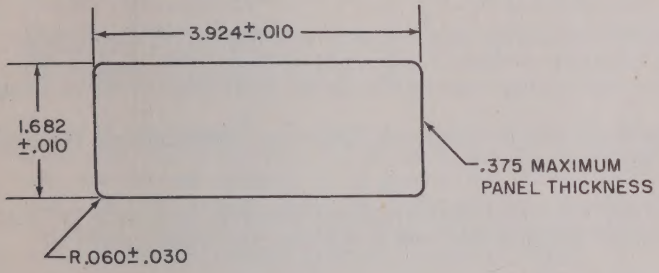

Figure 3. Panel Cut-Out Dimensions

ELECTRICAL ADJUSTMENT AND OPERATION

The Model 1292 has provisions to accept two connectors at the rear, Upper Analog Connector Model 9790-0267253 (ELCO #00-6007-030-980-002) and Lower Digital Connector Model 9790-0271102 (ELCO #00-6007-020-980-300).

For operation without utilizing BCD information the analog connector need only be used. The digital connector is used in conjunction with analog connector when the BCD information is needed.

The top connector is the analog connector and the bottom connector is the digital connector.

1. After the meter has been panel mounted, connect a 117 volt single phase power line as follows, on analog connector:

   a. One side of AC line to Pin #15

   b. One side of AC line to Pin #S

   c. Earth ground to Pin #R

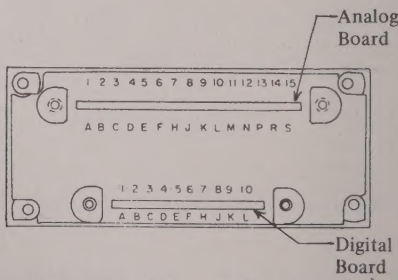

Figure 4. Rear View of Pin Designations

2. Allow meter to warm up for a period of 30 minutes.

3. Remove front assembly.

4. With signal input pins shorted (-) Pin #10 and (+) Pin #2. Rotate the (left) zero adjust potentiometer with a screw driver until the meter indicates 00.0, with (+) polarity lamp just on.

5. Connect a standard source to the signal input pins, (-) to pin #10. (+) to Pin #2 for 100 millivolts, 1 volt and current ranges. (+) to pin "A" for 10 volt, 100 volt and 1000 volt ranges. With full scale voltage applied, rotate the (center) positive full scale, adjust potentiometer with a screw driver until meter indicates + 1000 ±1 digit.

6. Reverse input signal. Connect a standard source to the signal input pins, (+) to pin #10. (-) to pin #2 for 100 millivolts, 1 volt and current ranges. (-) to pin "A" for 10 volt, 100 volt and 1000 volt ranges. With full scale voltage applied rotate the (right) negative full scale adjust potentiometer with a screwdriver until meter indicates - 1000 ± 1 digit.

7. Repeat steps 4, 5 and 6 as necessary until proper adjustment is achieved. The instrument is now ready for operation.

8. Full scale digital presentation of meter is as tabulated in Table 1. However, the meter is capable of being operated beyond this range plus 100% or minus 100%. For example, the operational range of 1 Volt DC meter is + 1.999 volts to - 1.999 volts.

9. When an over-range situation exists 1.999 volts applied to a 1 volt range. The quantity displayed is direct reading. If the applied input voltage is greater than ± 100% of range an out-range indicator will light to indicate this condition.

10. External Selection of decimal points are provided at the rear anolog connector. Connecting a 22K ±10% 1/4 watt carbon resistor between Terminal "N" and Terminals #12, #13 or #14 will select decimal point units (#12), tens (#13) or hundreds (#14).

Note: Before using external decimal point selection, solder jumper must be removed from digital board. Location of jumper is at left of base of readout tubes. Position is dependent on range of instrument.

11. The following table depicts basic conditions which may exist during the course of normal meter operation. The example given is for a one volt range meter.

APPLIED SIGNAL VOLTAGE	SIGNAL INPUT POLARITY	INDICATION ON DISPLAY TUBES	OUT-RANGE INDICATION
+3.0	Normal	+XXX	ON
+2.200	Normal	+.200	ON
+.000 to 1.999	Normal	+.000 to 1.999	OFF
-.000 to 1.999	Reversed	-.000 to 1.999	OFF
-2.200	Reversed	-.200	ON
-3.0	Reversed	-XXX	ON

12. Digital Connector:

To maintain the last reading on the display tubes and the BCD output terminals, the Model 1292 is equipped with a display hold contact on digital connector pin #8. By closing a switch between pin #8 and pin "J" (Digital GND), the last display and BCD can be held for as long as desired. By opening the switch, normal operation is resumed. Synchronization of a number of Model 1292 units can be obtained by controlling the hold circuitry externally.

13. To maintain the last polarity indication the Model 1292 is equipped with a polarity hold contact on digital connector pin #7. By closing a switch between pin #7 on digital connector and VCC (3.6V) pin "M" on analog connector. The last display and logic can be held for as long as desired. Opening the switch resumes normal operation.

14. Three decades of 1-2-4-8 BCD and the numeric 1000 are provided at the rear digital connector of the instrument to drive external devices. The rise and fall time of the output is compatible with industrial RTL (Resistor-Transistor-logic) micrologic or its equal. Logic levels are: Logical 1 equal to or greater than 1 Volt DC, and Logical 0 equal to or less than 0.4 Volt DC. For applications where other logic levels must be met, interface criteria should be coordinated with the factory.

15. The print command P.C. pin "H" of Digital Connector is used to provide a logic "O" (As shown in Figure 6) 1 microsecond output signal when conversion from analog to digital is complete. The purpose of P.C. is to key the external devices (see Step 14) for information acceptance.

Note: See Figure 4 and 7 for all rear connector pin designations.

THEORY OF OPERATION

GENERAL

This section in conjunction with the block diagram Figure 5 and waveforms Figure 6, contains a discussion of the theory of operation of the Model 1292 Digital Panel Meter.

Basically, the Model 1292 is a single range, high input impedance, bi-polar digital panel meter that is capable of being constructed as a voltmeter or current meter with the addition of an appropriate attenuator or shunt. Standard self-contained current or voltage ranges are available from Weston as shown in Table I.

The instrument utilizes a dual slope integrating technique designed with sampling intervals related to the power line frequency. Dual slope is a method of A/D conversion which, grants immunity to random and power frequency noise accompanying the input signal or as power supply ripple. Integrating time in the Model 1292 is 200 milliseconds, providing excellent rejection of 50 Hz, 60 Hz to 400 Hz of whose periods are sub-multiples of 200 milliseconds.

Dual slope converts the input signal into a ratio of two time intervals, both proportional to clock period making the accuracy of conversion independent of clock accuracy. The accuracy of conversion is dependent upon the stability of the internal reference circuits.

Waveforms are shown in Figure 6, Page 15. The integrating time T is constant at 200 milliseconds, corresponding to 8000 pulses from the 40K Hz clock oscillator.

The cycle, is divided into two intervals; ramp up t_1, and ramp down t_2. During t_1 the integrator charges to a voltage $\frac{e_{in}\, t_1}{RC}$.

During t_2, the capacitor discharges an equal amount under the influence of e_{in} and I_{Ref}.

I_{Ref} such that $$\frac{e_{in}\ t_1}{RC} = \frac{(I_{Ref} - e_{in})}{R}\ \frac{t_2}{C}$$

and Since $t_1 + t_2 = T$ $$t_2 = \frac{e_{in}\ T}{I_{Ref}\ R}$$

Now the interval T is determined by 8,000 clock pulses and thus lasts $8,000/f_{clock}$ seconds. The number of clock pulses N in t_2 is $t_{2fclock}$.

Thus

$$N = \frac{e_{in}\ 8000}{I_{Ref}\ R}$$

A quantity independent of f_{clock} Since the interval t_2 starts at a count of 8,000 (or zero) the count at the end of t_2 is equal to N. A storage and/or print command at that time transfers the count into display storage.

The conversion process is cyclic with a conversion every 200 milliseconds. If the new count is the same as the previous one, the number in storage will not change, and no display flicker results. The key events in each cycle are the count "8,000" which initiates t_2 by introducing a reference current and the crossing of zero by the integrator which terminates t_2 and commands a readout into storage. The polarity of the reference current can be negative or positive depending on the polarity of e_{in}.

OPERATION

(See Figures 5 and 6)

A 40K Hz clock oscillator runs continuously (except for a 1 micro second interval during readout to prevent a logical race condition.) The 40K Hz clock signal drives an 8,000 bit counter chain consisting of three decade dividers and three flip-flops U12B, U14A, U14B. The decade dividers drive the three decades of storage and display. The three flip-flops register the 1000 count and provide overrange sensing and control functions. Waveforms at the three flip-flops are shown at "A", "B" and "C" of figure 6.

The state 8,000 (defined when "B" and "C" simultaneously go to zero) is a reference condition which occurs only once in 8,000 pulses. (end of T_1) In detecting 8,000 waveform "D" goes from 0 to 1, a transition which sets the Ramp Down Latch producing a negative pulse waveform "J". (see figure 6)

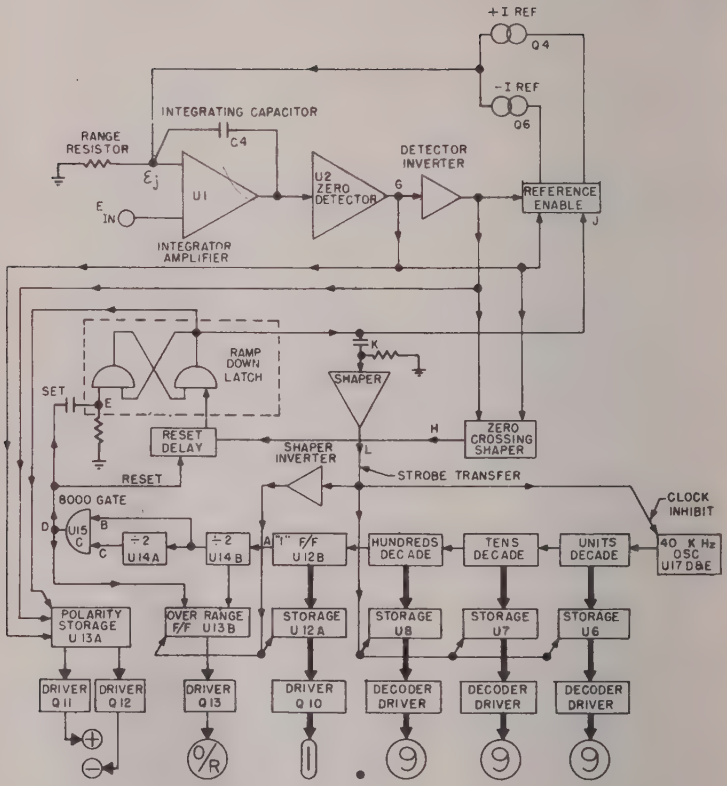

Figure 5. Block Diagram

When set the ramp down latch it permits a reference current to be injected into the integrator (C4) starting interval t_2. Simultaneously, the negative transition of "J" triggers Polarity Storage F-F U13A causing it to take a state determined by the polarity of the input signal and the state of the integrator at that time. For the present example, a positive input causes a positive ramp. Therefore, at the onset of t_2, "F" is at its greatest positive value "G" is negative since U2 inverts. U2 and detector inverter provide steering inputs to Polarity Store U13A, causing one or the other polarity indicator to be set. Polarity indication will remain fixed, as long as the input polarity remains the same.

During t_2 the "O" state of the ramp down latch enables "IRef enable" permitting one of the reference current generators to inject a 400 μA current into the summing junction. The choice of polarity is made by the control logic under the steering inputs provided by U2 and detector inverter. When the input signal polarity is positive, a positive current is injected into the summing junction forcing the integrator back to zero.

Interval t_2 ends when the integrator reaches zero. In so doing the zero comparator U2 undergoes an abrupt positive transition. The resulting waveform generated at "G" is shaped into a negative trigger pulse at "H". (If the input voltage had been negative a negative transition at "G" would be similarly shaped after inversion by the detector inverter. Therefore, any zero-crossing is converted into a negative trigger pulse).

The zero-crossing trigger pulse at "H" is inverted and applied to the reset the Ramp-Down-Latch. It will be noted that the positive transition of waveform "D" is coupled over to the reset inverter. This provides a 5 micro second inhibit period which prevents a logical race condition at zero input level.

When the Ramp Down Latch is reset, the resulting positive transition at "J" accomplishes several things. First, it is shaped and inverted into a 1 microsecond negative pulse waveform "L". This commands the storage registers U8, U7, U6 to accept new count information from the decade counters. The count transferred at this time will be N as developed during t_2. The storage registers will remain receptive to changing count data so long as the command pulse is low. Time is thus made available for

ripple through of carrys which may have started just prior to reset. During the storage command pulse, the clock oscillator is momentarily clamped preventing any new pulses from entering the counter.

At the termination of the storage pulse L, the storage registers are locked up at their new condition and the read out tubes they drive remain fixed in display.

The trailing edge of the storage pulse activates two more functions. It commands storage of the state of the "thousands" counter U12B into storage register U12A. Also, it triggers overrange Flip-Flop U13B. This register is set to zero (lamp off) at the start of t_2. It will toggle to "1" (lamp on) when triggered only if both steering inputs are low. This condition "B" low will occur after the count of 2,000 and up to 4,000, which is the stable overrange condition.

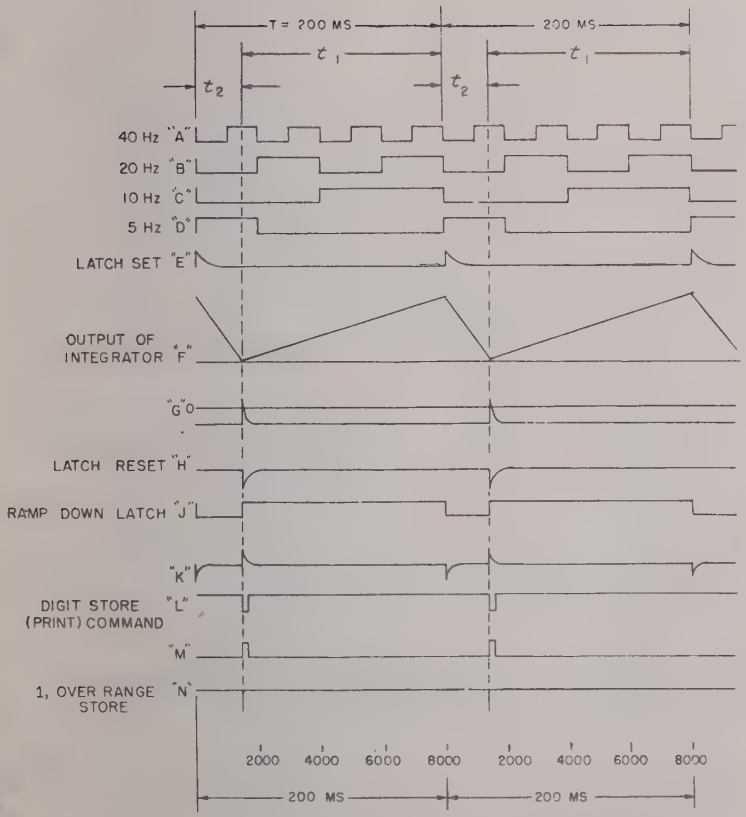

Figure 6. Waveforms

WESTON EQUIPMENT WARRANTY

Weston warrants equipment of its manufacture against defective materials or workmanship for a period of one year from date of shipment.

The liability of Seller under this warranty is limited, at Seller's option, solely to repair, replacement with equivalent Weston equipment, at an appropriate credit adjustment not to exceed the original equipment sales price, of equipment returned to the Seller provided that (a) Seller is promptly notified in writing by Buyer upon discovery of defects, (b) Upon receipt of written authorization from Seller the defective equipment is returned as directed, transportation charges prepaid by Buyer, and, (c) Seller's examination of such equipment discloses to his satisfaction that defects were not caused by negligence, misuse, improper installation, accident, or unauthorized repair or alteration by the Buyer. Any modification such as changing range resistors may void this warranty.

This warranty does not include mechanical parts failing from normal usage nor does it cover limited life electrical components which deteriorate with age such as tubes, lamps, etc.

This warranty is in lieu of all other warranties, expressed or implied, including the implied warranty of fitness for a particular purpose to the original purchaser or to any other person. Seller shall not be liable for consequential damages of any kind.

The aforementioned provisions do not extend the original warranty period of any article which has been either repaired or replaced by Seller.

REPLACEMENT PARTS LIST

MODEL 1292

REFERENCE SYMBOL	DESCRIPTION	WESTON PART NO.
	BOARD ASSEMBLY ANALOG	268972-913
C1	Capacitor, 1.0 μf 200 WVDC	269895-001
C2	Capacitor, 1600 μf 10 WVDC	266607-001
C3	Capacitor, 250 μf 64 WVDC	266349-001
C4	Capacitor, 1.70 μf 50 WVDC	269897-001
C5	Capacitor, .68 μf 50 WVDC	270034-001
C6	Capacitor 2.2 μf 35 WVDC	269953-001
C10, C11	Capacitor, .01 μf 100 WVDC	269899-001
C7	Capacitor, 220 pf 100 WVDC	264091-001
C8	Capacitor, .0047 μf 100 WVDC	264092-001
C9	Capacitor, 120 pf 100 WVDC	264090-001
CR1	Diode, IN5060	266591-001
CR2, CR3, CR4	Diode, IN5059	266611-001
CR5, CR6	Diode, IN4742	264601-001
CR7, CR8	Diode, IN823	60978-001
F1	Fuse, 1/4 Amp.	268798-001
P1	Plug Assembly	269227-901
Q1	Transistor, D28C1	268797-001
Q2	Transistor, D27C3	269902-001
Q3, Q5, Q8, Q9	Transistor, 2N2712	39917-001
Q4	Transistor, TD401	269904-001
Q6	Transistor, TD101	266399-001
Q7	Transistor, 2N5354	268795-001
R1	Resistor, 9.09K Ohms	269883-001
R2	Resistor, 14K Ohms	269882-001
R3	Resistor, 3.3K Ohms	269890-001
R4	Resistor, 18 Ohms	269889-001
R5, R11	Potentiometer, 2K Ohms	269901-001
R6, R12	Resistor, 14.7 K Ohms	264695-001
R7, R10, R13, R17	Resistor, 12K Ohms	266613-001
R8, R14	Resistor, 825 Ohms	269888-001
R9, R15	Resistor, 4.7K Ohms	263652-001
R16	Resistor, 47K Ohms	264676-001
R19, R20	Resistor, 100K Ohms	269885-001
R21, R26	Resistor, 1.5K Ohms	264677-001
R22	Resistor, 49.9K Ohms	269884-001

REFERENCE SYMBOL	DESCRIPTION	WESTON PART NO.
R24, R25	Resistor, 10K Ohms	269887-001
R30	Resistor, 49.9 Ohms	269886-001
R18, R27, R28, R29	Resistor, Selected for range per Table - Page 18	
R31	Resistor, 2.0 Meg. Ohm	269932-001
R23	Potentiometer, 50K Ohm	266407-001
T1	Transformer, Power	270502-901
U1	Microcircuit, TOA 8809 (60106)	266654-001
U2	Microcircuit, MC710G	269903-001
—	Heat Sink	265677-901
	BOARD ASSEMBLY, Digital	268969-901
C12, C13	Capacitor, 1000 pf 100 WVDC	269893-001
C14	Capacitor, Trimmer (90-400 pf)	269894-001
C15	Capacitor, 220 pf	264091-001
C16, C17, C18, C19	Capacitor, .001 μf	263666-001
CR9	Diode S262	263643-001
DS1, DS2, DS3	Tube, Readout B5855S	266601-001
DS4	Bulb, Neon, A261	266537-001
DS5, DS6, DS7	Bulb, Neon, A1B	269877-001
J1	Socket Assy.	269228-901
Q10, Q11, Q12, Q13	Transistor, 2N5175	266585-001
R40, R41, R42 R43, R47, R48 R50, R51, R6	Resistor, 2.4K Ohms	266615-001
R44, R45, R49	Resistor, 6.8K Ohms	269891-001
R46	Resistor, 1.0K Ohms	266612-001
R52, R53	Resistor, 22.1K Ohms	269955-001
R54, R55, R56	Resistor, 10K Ohms	264673-001
R57, R58, R59	Resistor, 47K Ohms	264676-001
R61	Resistor, 2.2K Ohms	265866-001
R62	Resistor 22K Ohms	264674-001
R63, R64	Resistor, 6.8K Ohms	266592-001
U3, U4, U5	Microcircuit UL 9960	266397-001
U6, U7, U8	Microcircuit UL 9959	266595-001

REFERENCE SYMBOL	DESCRIPTION	WESTON PART NO.
U9, U10, U11	Microcircuit UL 9958	266596-001
U12, U14	Microcircuit MC878P	266597-001
U13	Microcircuit MC876P	266600-001
U15	Microcircuit MC824P	266599-001
U16	Microcircuit MC817P	266598-001
U17	Microcircuit MC889P	269896-001
XDS1, XDS2, XDS3	Socket, Readout Tube	266602-001

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